What is claimed:

SUB A4

1. A method of forming a copper damascene structure, comprising:

forming a first opening through a first insulating layer;

forming a second opening through a second insulating layer which is provided over the first insulating layer, the first opening being in communication with the second opening;

forming a tungsten-nitride ($WN_2$) layer in contact with the first and second openings; and

providing a copper layer in the first and second openings using a selective electroless deposition technique.

2. The method of claim 1, wherein the first insulating layer includes oxide material.

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3. The method of claim 1, wherein the first insulating layer includes a material selected from the group consisting of polyimide, spin-on-polymers, flare, polyarylethers, parylene, polytetrafluoroethylene, benzocyclobutene, SILK, fluorinated silicon oxide, hydrogen silsesquioxane and NANOGLASS.

4. The method of claim 1, wherein the first insulating layer is formed by deposition to a thickness of about 2,000 to 15,000 Angstroms.

5. The method of claim 4, wherein the first insulating layer is formed by deposition to a thickness of about 6,000 to 10,000 Angstroms.

6. The method of claim 1, wherein the second insulating layer includes oxide material.

7. The method of claim 1, wherein the second insulating layer includes a material selected from the group consisting of polyimide, spin-on-polymers, flare, polyarylethers, parylene, polytetrafluoroethylene, benzocyclobutene, SILK, fluorinated silicon oxide, hydrogen silsesquioxane and NANOGLASS.

8. The method of claim 1, wherein the second insulating layer is formed by deposition to a thickness of about 2,000 to 15,000 Angstroms.

9. The method of claim 8, wherein the second insulating layer is formed by deposition to a thickness of about 6,000 to 10,000 Angstroms.

10. The method of claim 1, wherein the first and second insulating layers are formed of same material.

11. A method of forming a copper damascene structure, comprising:

forming a first opening through a first insulating layer;

forming a second opening through a second insulating layer which is provided over the first insulating layer, the first opening being in communication with the second opening;

forming a tungsten-nitride ($WN_2$) layer using atomic layer deposition such that the tungsten-nitride ($WN_2$) layer is in contact with the first and second openings; and

providing a copper layer in the first and second openings using a selective electroless deposition technique.

12. The method of claim 11, wherein forming a tungsten-nitride ($WN_2$) layer using atomic layer deposition includes forming a tungsten-nitride ($WN_2$) layer which has a thickness of less than five atomic layers.

13. The method of claim 11, wherein the tungsten-nitride ($WN_2$) layer is deposited at a temperature of about 600-800 Kelvin.

14. The method of claim 11, wherein the copper layer is selectively deposited at a temperature of about 300°C to about 400°C.

15. The method of claim 11, wherein the copper layer is selectively deposited by an electroless plating deposition technique which includes the use of noble metal seeding using copper, gold, palladium, or platinum.

16. The method of claim 11, wherein the copper layer is selectively deposited by wet activation of surfaces using a contact displacement method, wherein the contact displacement copper deposition is used to first selectively activate the tungsten-nitride ($WN_2$) layer after which selective electroless copper deposition is employed to obtain the copper layer.

17. The method of claim 11, wherein the method further includes using a chemical mechanical polishing technique to remove the tungsten-nitride ($WN_2$) layer from a top surface of the second insulating layer prior to providing a copper layer in the first and second openings.

18. The method of claim 11, wherein the method further includes using a chemical mechanical polishing technique to remove the copper layer from a top surface of the second insulating layer.

19. A method of forming a copper damascene structure, comprising:

forming a first opening through a first insulating layer;

forming a second opening through a second insulating layer which is provided over the first insulating layer, the first opening being in communication with the second opening;

forming a tungsten-nitride ($WN_2$) layer, which is less than five atomic layers thick, using atomic layer deposition such that the tungsten-nitride ($WN_2$) layer is in contact with the first and second openings, and wherein the tungsten-nitride ($WN_2$) layer is deposited at a temperature of about 600-800 Kelvin; and

providing a copper layer in the first and second openings using a selective electroless deposition technique.

20. The method of claim 19, wherein the copper layer is selectively deposited at a temperature of about 300°C to about 400°C.

21. The method of claim 19, wherein the copper layer is selectively deposited by an electroless plating deposition technique which includes the use of noble metal seeding using copper, gold, palladium, or platinum.

22. The method of claim 19, wherein the copper layer is selectively deposited by wet activation of surfaces using a contact displacement method, wherein the contact displacement copper deposition is used to first selectively activate the tungsten-nitride ($WN_2$) layer after which selective electroless copper deposition is employed to obtain the copper layer.

23. The method of claim 19, wherein the method further includes using a chemical mechanical polishing technique to remove the tungsten-nitride ($WN_2$) layer from a top surface of the second insulating layer prior to providing a copper layer in the first and second openings.

24. The method of claim 19, wherein the method further includes using a chemical mechanical polishing technique to remove the copper layer from a top surface of the second insulating layer.

25. A method of forming a copper damascene structure, comprising:

forming a first opening through a first insulating layer;

forming a second opening through a second insulating layer which is provided over the first insulating layer, the first opening being in communication with the second opening;

forming a tungsten-nitride ($WN_2$) layer, which is less than five atomic layers thick, using atomic layer deposition such that the tungsten-nitride ($WN_2$) layer is in contact with the first and second openings, and wherein the tungsten-nitride ($WN_2$) layer is deposited at a temperature of about 600-800 Kelvin; and

providing a copper layer in the first and second openings using a selective electroless deposition technique at a temperature of about 300°C to about 400°C.

26. The method of claim 25, wherein the copper layer is selectively deposited by an electroless plating deposition technique which includes the use of noble metal seeding using copper, gold, palladium, or platinum.

27. The method of claim 25, wherein the copper layer is selectively deposited by wet activation of surfaces using a contact displacement method, wherein the contact displacement copper deposition is used to first selectively activate the tungsten-nitride ($WN_2$) layer after which selective electroless copper deposition is employed to obtain the copper layer.

28. The method of claim 25, wherein the method further includes using a chemical mechanical polishing technique to remove the tungsten-nitride ($WN_2$) layer from a top surface of the second insulating layer prior to providing a copper layer in the first and second openings.

29. The method of claim 25, wherein the method further includes using a chemical mechanical polishing technique to remove the copper layer from a top surface of the second insulating layer.

30. A dual damascene structure, comprising:

a substrate;

a metal layer provided within the substrate;

a first insulating layer located over the substrate;

a via situated within the first insulating layer and extending to at least a portion of the metal layer, the via being lined with a tungsten-nitride ($WN_2$) layer and filled with a copper material;

a second insulating layer located over the first insulating layer;

a trench situated within the second insulating layer and extending to the via, the trench being lined with the tungsten-nitride ($WN_2$) layer and selectively filled with the copper material using a selective electroless deposition technique.

31. The dual damascene structure of claim 30, wherein the first insulating layer includes a material selected from the group consisting of polyimide, spin-on-polymers, flare, polyarylethers, parylene, polytetrafluoroethylene, benzocyclobutene, SILK, fluorinated silicon oxide, hydrogen silsesquioxane and NANOGLASS.

32. The dual damascene structure of claim 30, wherein the first insulating layer includes silicon dioxide.

33. The dual damascene structure of claim 30, wherein the first insulating layer has a thickness of about 2,000 to 15,000 Angstroms.

34. The dual damascene structure of claim 30, wherein the second insulating layer includes a material selected from the group consisting of polyimide, spin-on-polymers, flare, polyarylethers, parylene, polytetrafluoroethylene, benzocyclobutene, SILK, fluorinated silicon oxide, hydrogen silsesquioxane and NANOGLASS.

35. The dual damascene structure of claim 30, wherein the second insulating layer includes silicon dioxide.

36. The dual damascene structure of claim 30, wherein the second insulating layer has a thickness of about 2,000 to 15,000 Angstroms.

37. A dual damascene structure, comprising:

a substrate;

a metal layer provided within the substrate;

a first insulating layer located over the substrate;

a via situated within the first insulating layer and extending to at least a portion of the metal layer, the via being lined with a tungsten-nitride ($WN_2$) layer, wherein the tungsten-nitride ($WN_2$) layer has a thickness of about 500 Angstroms to about 200 Angstroms, and filled with a copper material;

a second insulating layer located over the first insulating layer;

a trench situated within the second insulating layer and extending to the via, the trench being lined with the tungsten-nitride ($WN_2$) layer, wherein the tungsten-nitride ($WN_2$) layer has a thickness of about 500 Angstroms to about 200 Angstroms, and selectively filled with the copper material using a selective electroless deposition technique.

38. The dual damascene structure of claim 37, wherein the tungsten-nitride ($WN_2$) layer has a thickness of about 100 Angstroms.

39. The dual damascene structure of claim 37, wherein the copper material includes copper or a copper alloy.

40. The dual damascene structure of claim 37, wherein the substrate is a semiconductor substrate.

41. The dual damascene structure of claim 37, wherein the substrate is a silicon substrate.

42. A dual damascene structure, comprising:

a substrate;

a metal layer provided within the substrate;

a first insulating layer located over the substrate;

a via situated within the first insulating layer and extending to at least a portion of the metal layer, the via being lined with a tungsten-nitride ($WN_2$) layer which is less than five atomic layers thick formed using atomic layer deposition at a temperature of about 600-800 Kelvin, and selectively filled with a copper material;

a second insulating layer located over the first insulating layer;

a trench situated within the second insulating layer and extending to the via, the trench being lined with the tungsten-nitride ($WN_2$) layer which is less than five atomic layers thick formed using atomic layer deposition at a temperature of about 600-800 Kelvin, and selectively filled with the copper material using a selective electroless deposition technique.

43. The dual damascene structure of claim 42, wherein the via and the trench being lined with a tungsten-nitride ($WN_2$) layer and filled with copper includes copper which is selectively deposited at a temperature of about 300°C to about 400°C.

44. The dual damascene structure of claim 42, wherein the copper layer is selectively deposited by an electroless plating deposition technique which includes the use of noble metal seeding using copper, gold, palladium, or platinum.

45. The dual damascene structure of claim 42, wherein the copper layer is selectively deposited by wet activation of surfaces using a contact displacement method, wherein the contact displacement copper deposition is used to first

selectively activate the tungsten-nitride ($WN_2$) layer after which selective electroless copper deposition is employed to obtain the copper layer.

46. A damascene structure, comprising:

a substrate;

a metal layer provided within the substrate;

at least one insulating layer located over the substrate; and

at least one opening situated within the at least one insulating layer and extending to at least a portion of the metal layer, the opening being lined with a tungsten-nitride ($WN_2$) layer formed using atomic layer deposition at a temperature of about 600-800 Kelvin, and filled with a copper material using a selective electroless deposition technique.

47. The damascene structure of claim 46, wherein the at least one insulating layer includes a material selected from the group consisting of polyimide, spin-on-polymers, flare, polyarylethers, parylene, polytetrafluoroethylene, benzocyclobutene, SILK, fluorinated silicon oxide, hydrogen silsesquioxane and NANOGLASS.

48. The damascene structure of claim 46, wherein the at least one insulating layer includes silicon dioxide.

49. The damascene structure of claim 46, wherein the at least one insulating layer has a thickness of about 2,000 to 15,0000 Angstroms.

50. The damascene structure of claim 46, wherein the tungsten-nitride ($WN_2$) layer has a thickness of about 50 Angstroms to about 200 Angstroms.

51. The damascene structure of claim 46, wherein the tungsten-nitride ($WN_2$) layer has a thickness of about 100 Angstroms.

52. The damascene structure of claim 46, wherein the copper material includes copper or a copper alloy.

53. A damascene structure, comprising:

a substrate;

a metal layer provided within the substrate;

at least one insulating layer located over the substrate;

at least one opening situated within the at least one insulating layer and extending to at least a portion of the metal layer, the opening being lined with a tungsten-nitride ($WN_2$) layer formed using atomic layer deposition at a temperature of about 600-800 Kelvin, and filled with a copper material; and

wherein the opening being lined with a tungsten-nitride ($WN_2$) layer and filled with copper includes copper which is selectively deposited using a selective electroless deposition technique at a temperature of about 300°C to about 400°C.

54. The damascene structure of claim 53, wherein the copper layer is selectively deposited by an electroless plating deposition technique which includes the use of noble metal seeding using copper, gold, palladium, or platinum.

55. The damascene structure of claim 53, wherein the copper layer is selectively deposited by wet activation of surfaces using a contact displacement method, wherein the contact displacement copper deposition is used to first selectively activate the tungsten-nitride ($WN_2$) layer after which selective electroless copper deposition is employed to obtain the copper layer.

56. The damascene structure of claim 53, wherein the substrate is a semiconductor substrate.

57. The damascene structure of claim 53, wherein the substrate is a silicon substrate.

58. An electronic system comprising:

a processor; and

an integrated circuit coupled to the processor, at least one of the processor and integrated circuit including a damascene structure, the damascene structure comprising a metal layer over a substrate, at least one insulating layer located over the metal layer, and at least one opening situated within the at least one insulating layer and extending to at least a portion of the metal layer, the opening being lined with a tungsten-nitride ($WN_2$) layer and filled with copper using a selective electroless deposition technique.

59. The electronic system of claim 58, wherein the processor and the integrated circuit are integrated on the same chip.

60. The electronic system of claim 58, wherein the tungsten-nitride ($WN_2$) layer has a thickness of about 500 Angstroms to about 200 Angstroms.

61. The electronic system of claim 58, wherein the tungsten-nitride ($WN_2$) layer has a thickness of about 100 Angstroms.

62. The electronic system of claim 58, wherein the tungsten-nitride ($WN_2$) layer includes a is deposited at a temperature of about 600-800 Kelvin.

63. The electronic system of claim 58, wherein the opening being lined with a tungsten-nitride ($WN_2$) layer and filled with copper includes copper which is selectively deposited using a selective electroless deposition technique at a temperature of about 300°C to about 400°C.

64. The electronic system of claim 58, wherein the copper layer is selectively deposited by an electroless plating deposition technique which includes the use of noble metal seeding using copper, gold, palladium, or platinum.

65. The electronic system of claim 58, wherein the copper layer is selectively deposited by wet activation of surfaces using a contact displacement method, wherein the contact displacement copper deposition is used to first selectively activate the tungsten-nitride ($WN_2$) layer after which selective electroless copper deposition is employed to obtain the copper layer.